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(71) Applicant: **HONDA MOTOR CO LTD**

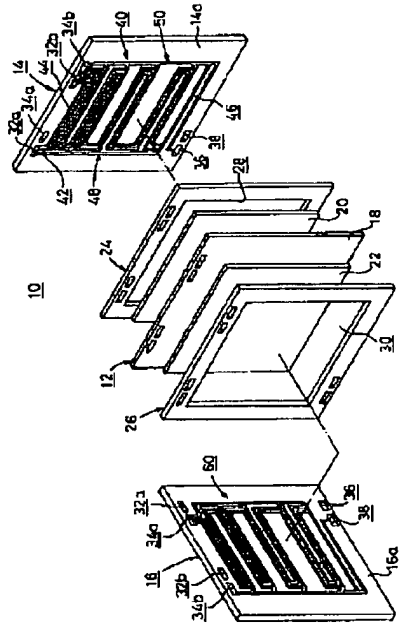
(72) Inventor: **KOSAKA YUICHIRO**
SUZUKI SEIJI

(54) **FUEL CELL**

(57) Abstract:

PROBLEM TO BE SOLVED: To maintain proper gas diffusivity and water drainage with a simple constitution.

SOLUTION: The first and the second separators 14 and 16 have a fuel gas flow passage 40 and an oxidant gas flow passage 60. The fuel gas flow passage 40 has the first to the third main flow passage channels 42, 44 and 46 meandering from an inlet port 32a to an outlet port 36 for communication, and the first and the second auxiliary flow passage channels 48 and 50 joining the first to the third main flow passage channels 42, 44 and 46.



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(71)出願人　000005326
本田技研工業株式会社
東京都港区南青山二丁目１番１号
(72)発明者　小坂　祐一郎
埼玉県和光市中央１－４－１　株式会社本田技術研究所内
(72)発明者　鈴木　征治
埼玉県和光市中央１－４－１　株式会社本田技術研究所内
(74)代理人　100077665
弁理士　千葉　剛宏　（外１名）

(54)【発明の名称】　燃料電池

(57)【要約】
【課題】簡単な構成で、良好なガス拡散性および排水性を確保することを可能にする。
【解決手段】第１および第２セパレータ１４、１６は、燃料ガス流路４０および酸化剤ガス流路６０を有する。燃料ガス流路４０は、第１セパレータ１４の面１４ａ内において、入口孔部３２ａから出口孔部３６に蛇行して連なる第１～第３主流路溝４２、４４および４６と、前記第１～第３主流路溝４２、４４および４６に合流する第１および第２補助流路溝４８、５０とを備えている。

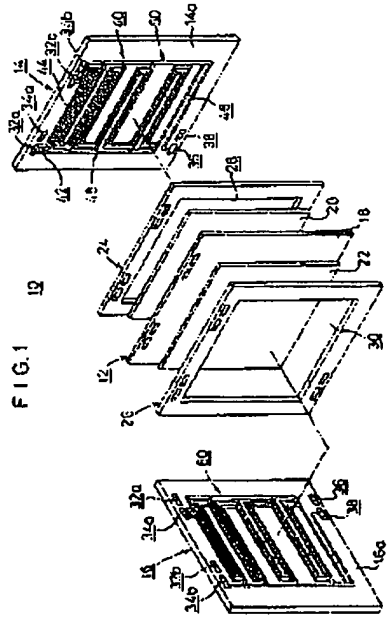

FIG.1

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【特許請求の範囲】

【請求項１】電解質をアノード側電極とカソード側電極とで挟んで構成される単位燃料電池セルと、前記単位燃料電池セルを挟持する第１および第２セパレータとを備え．前記第１および第２セパレータは．前記アノード側電極および前記カソード側電極に燃料ガスおよび酸化剤ガスを供給する第１および第２ガス流路を有し．

少なくとも前記第１または第２ガス流路は、前記第１または第２セパレータの面内においてガス入口側からガス出口側に重力方向に蛇行して連なる主流路溝と．

前記ガス入口側から重力方向に直線的に設けられるとともに．前記主流路溝に合流する合流部位を有する補助流路溝と、

を備えることを特徴とする燃料電池。

【請求項２】請求項１記載の燃料電池において．前記補助流路溝は、前記ガス入口側に連通する直線部位と、

前記直線部位の途上からそれぞれ分岐して湾曲し．前記主流路溝の屈曲部に連通する複数の前記合流部位と、

を備えることを特徴とする燃料電池。

【請求項３】請求項１記載の燃料電池において．前記補助流路溝は、前記ガス入口側に連通する直線部位と、

前記直線部位の終端に連続して湾曲し．前記主流路溝の屈曲部に連通する前記合流部位と、

を備え、

複数本の前記補助流路溝が前記ガス入口側から設けられることを特徴とする燃料電池。

【請求項４】請求項１乃至３のいずれか１項に記載の燃料電池において．前記主流路溝は、前記ガス入口側の溝本数が前記ガス出口側の溝本数よりも多く設定されることを特徴とする燃料電池。

【請求項５】電解質をアノード側電極とカソード側電極とで挟んで構成される単位燃料電池セルと、前記単位燃料電池セルを挟持する第１および第２セパレータとを備え．

前記第１および第２セパレータは、前記アノード側電極および前記カソード側電極に燃料ガスおよび酸化剤ガスを供給する第１および第２ガス流路を有し、

少なくとも前記第１または第２ガス流路は、前記第１または第２セパレータの面内において．上部側のガス入口側から下方向に向かって面方向一側部側に傾斜した後、屈曲して下方向に向かって面方向他側部側に傾斜して下部側のガス出口側に連なる流路溝を備えることを特徴とする燃料電池。

【請求項６】請求項５記載の燃料電池において．前記流路溝は、前記第１または第２セパレータの面中央部から面方向両側部側に向かって多列に配置されることを特徴とする燃料電池。

【請求項７】電解質をアノード側電極とカソード側電極とで挟んで構成される単位燃料電池セルと、前記単位燃料電池セルを挟持する第１および第２セパレータとを備え．

前記第１および第２セパレータは、前記アノード側電極および前記カソード側電極に燃料ガスおよび酸化剤ガスを供給する第１および第２ガス流路を有し、

少なくとも前記第１または第２ガス流路は、前記第１または第２セパレータの面内において．横方向に分割されかつ上部側のガス入口側から下部側のガス出口側にそれぞれ独立して重力方向に蛇行しながら連通する複数本の流路溝を備えることを特徴とする燃料電池。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は．電解質をアノード側電極とカソード側電極とで挟んで構成される単位燃料電池セルと、前記単位燃料電池セルを挟持する第１および第２セパレータとを備えた燃料電池に関する。

【０００２】

【従来の技術】例えば、固体高分子型燃料電池は．高分子イオン交換膜（陽イオン交換膜）からなる電解質の両側にそれぞれアノード側電極およびカソード側電極を対設して構成された単位燃料電池セルを．セパレータによって挟持することにより構成されており、通常．前記単位燃料電池セルと前記セパレータとを所定数だけ積層して燃料電池スタックとして使用されている。

【０００３】この種の燃料電池において、アノード側電極に供給された燃料ガス．例えば、水素ガスは．触媒電極上で水素イオン化され．適度に加湿された電解質を介してカソード側電極側へと移動する。その間に生じた電子が外部回路に取り出され．直流の電気エネルギとして利用される。カソード側電極には、酸化剤ガス．例えば．酸素ガスあるいは空気が供給されているために、このカソード側電極において．前記水素イオン、電子および酸素が反応して水が生成される。

【０００４】ところで、アノード側電極およびカソード側電極にそれぞれ燃料ガスおよび酸化剤ガスを供給するために、通常．触媒電極層（電極面）に導電性を有する多孔質層、例えば、多孔質カーボンペーパがセパレータにより挟持されるとともに．各セパレータの互いに対向する面には、均一な幅寸法に設定された１本または複数本のガス流路が設けられている。

【０００５】

【発明が解決しようとする課題】しかしながら．上記の構成では、ガス流路に供給された燃料ガスや酸化剤ガスがセパレータの面内で消費されるため．このガス流路の出口付近における単位面積当たりの反応分子数が該ガス流路の入口側に比べて減少してしまう。これにより、電極面内での反応が不均一になり、セル性能が不安定になるという問題が指摘されている。

【０００６】さらに、ガス流路内には．凝結水分や反応によって生成された水分が．液体（水）の状態で存在することがある。この水が多孔質層に蓄積されると．燃料

ガスおよび酸化剤ガスの触媒電極層への拡散性が低下してしまい、セル性能が著しく悪くなるおそれがある。

【０００７】そこで、例えば、特開平６－２６７５６４号公報に開示されているように、アノード極に燃料を供給する燃料流路を有した燃料配流板と、カソード極に酸化剤を供給する酸化剤流路を有した酸化剤配流板とを具備し、前記酸化剤配流板の酸化剤流路の深さあるいは幅の少なくともいずれかを酸化剤の上流流路域から下流流路域に沿って徐々に小さくした燃料電池が知られている。

【０００８】ところが、上記の従来技術では、酸化剤流路の上流流路域の深さが大きくなってセパレータ自体が相当に肉厚なものとなってしまう。これにより、燃料電池全体の小型化が容易に遂行されないという問題が指摘されている。しかも、ガス流路の上流から下流に向かって深さを徐々に小さくする加工作業が、極めて煩雑なものになるという問題がある。

【０００９】本発明はこの種の問題を解決するものであり、簡単な構成で、良好なガス拡散性および排水性を確保することが可能な燃料電池を提供することを目的とする。

【００１０】

【課題を解決するための手段】本発明に係る燃料電池では、単位燃料電池セルを挟持する第１および第２セパレータが、アノード側電極およびカソード側電極に燃料ガスおよび酸化剤ガスを供給する第１および第２ガス流路を有するとともに、少なくともこの第１または第２ガス流路が、ガス入口側からガス出口側に重力方向に蛇行して延なる主流路溝と、このガス入口側から重力方向に直線的に設けられて前記主流路溝に合流する補助流路溝とを備えている。

【００１１】このため、ガス入口側からガス出口側に向かって主流路溝を流れるガスが消費される際、この主流路溝に合流する補助流路溝からガスが供給され、前記主流路溝でのガス流速の減少を有効に阻止することができる。従って、主流路溝でガスが加速され、ガス流速が速くなって排水性を確実に向上させることが可能になる。しかも、第１または第２セパレータの面内におけるガスの圧損を低減し得るとともに、補助流路溝を流れるガスが反応して前記第１または第２セパレータの面内における反応面積の増加を図ることができる。

【００１２】ここで、本発明では、補助流路溝がガス入口側に連通する直線部位と、この直線部位の途上からそれぞれ分岐して湾曲し、主流路溝の屈曲部に連通する複数の合流部位とを備えている。このため、補助流路溝を流れるガスの流速が低下することを有効に阻止して、主流路溝の各屈曲部に所望の流速でガスを円滑に供給することができる。

【００１３】また、補助流路溝が、ガス入口側に連通する直線部位と、この直線部位の終端に連続して湾曲し、主流路溝の屈曲部に連通する合流部位とを備えるとともに、前記補助流路溝が複数本設けられている。従って、各補助流路溝から主流路溝に加速されたガスを確実に供給することができ、この主流路溝内での排水性を向上させることが可能になる。

【００１４】さらに、主流路溝がガス入口側の溝本数をガス出口側の溝本数よりも多く設定されている。これにより、ガスの消費に伴って溝本数が減少するため、ガス出口側の単位面積当たりの反応分子数がガス入口側に比べて減少することがなく、電極面内での反応の均一化を図ることができる。

【００１５】さらにまた、本発明では、少なくとも第１または第２ガス流路が、第１または第２セパレータの面内において、上部側のガス入口側から下方向に向かって面方向一側部側に傾斜した後、屈曲して下方向に向かって面方向他側部側に傾斜して下部側のガス出口側に連なる流路溝を備えている。従って、第１または第２ガス流路を第１または第２セパレータの面内に対し電極面に沿って設けるとともに、流路溝が下方向に向かって傾斜しており、前記流路溝内の生成水が重力の作用下にガス出口側に自由落下する。これにより、流路溝内の生成水の排出性が大幅に向上する。

【００１６】ここで、流路溝が第１または第２セパレータの面中央部から面方向両側部側に向かって多列に配置されている。このため、電極面に対してガスを均一かつ確実に供給することが可能になる。

【００１７】また、本発明では、少なくとも第１または第２ガス流路が、第１または第２セパレータの面内において、横方向に分割されかつ上部側のガス入口側から下部側のガス出口側にそれぞれ独立して重力方向に蛇行しながら連通する複数本の流路溝を備えている。これにより、ガス入口側からガス出口側に至る各流路溝の溝長さを一挙に短尺化することができ、前記流路溝内で生成される水の排出性が大幅に向上する。しかも、各流路溝の溝長さを短尺化することにより、酸化剤ガスまたは燃料ガスの濃度分布のバラツキを少なくすることができ、燃料電池の発電性能を有効に向上させることが可能になる。

【００１８】

【発明の実施の形態】図１は、本発明の第１の実施形態に係る燃料電池１０の要部分解斜視図である。燃料電池１０は、単位燃料電池セル１２と、この単位燃料電池セル１２を挟持する第１および第２セパレータ１４、１６とを備え、必要に応じてこれらが複数組だけ積層されて燃料電池スタックを構成している。

【００１９】単位燃料電池セル１２は、固体高分子電解質膜１８と、この電解質膜１８を挟んで配設されるアノード側電極２０およびカソード側電極２２とを有する。

【００２０】単位燃料電池セル１２の両側には、第１および第２ガスケット２４、２６が設けられ、前記第１ガ

スケット２４は、アノード側電極２０を収納するための大きな開口部２８を有する一方、前記第２ガスケット２６は、カソード側電極２２を収納するための大きな開口部３０を有する。単位燃料電池セル１２と第１および第２ガスケット２４、２６とが、第１および第２セパレータ１４、１６によって挟持される。

【００２１】図１～図３に示すように、第１および第２セパレータ１４、１６は、それぞれの上部側に水素ガス等の燃料ガスを通過させるための入口孔部３２ａ、３２ｂと、酸素または空気である酸化剤ガスを通過させるための入口孔部３４ａ、３４ｂとを設ける。第１セパレータ１４の下部側には、燃料ガスを通過させるための出口孔部３６と、酸化剤ガスを通過させるための出口孔部３８とが設けられる。

【００２２】図２に示すように、第１セパレータ１４のアノード側電極２０に対向する面１４ａには、入口孔部３２ａ、３２ｂと出口孔部３６とを連通する燃料ガス流路（第１ガス流路）４０が形成される。燃料ガス流路４０は、入口孔部３２ａに連通して面１４ａ内において重力方向（矢印Ａ方向）に向かって蛇行する第１および第２主流路溝４２、４４と、前記第１および第２主流路溝４２、４４が一体的に合流した後に出口孔部３６に連通する第３主流路溝４６と、入口孔部３２ａ、３２ｂから重力方向に直線的に設けられて前記第１～第３主流路溝４２、４４および４６に合流する第１および第２補助流路溝４８、５０とを備える。

【００２３】第１および第２主流路溝４２、４４は、第１セパレータ１４の上部側から下方向（矢印Ａ方向）に向かって互いの隣間間隔およびそれぞれの流路溝間隔が大きくなるように構成されており、出口孔部３６側で互いに合流して第３主流路溝４６が設けられる。第１および第２補助流路溝４８、５０は、入口孔部３２ａ、３２ｂに連通して矢印Ａ方向に延在する直線部位５２、５４と、前記直線部位５２、５４の途上からそれぞれ分岐して湾曲し、第１および第２主流路溝４２、４４の屈曲部に連通する複数の合流部位５６ａ～５６ｄおよび５８ａ～５８ｄとを備えている。

【００２４】図３に示すように、第２セパレータ１６のカソード側電極２２に対向する面１６ａには、入口孔部３４ａ、３４ｂと出口孔部３８とを連通する酸化剤ガス流路（第２ガス流路）６０が形成される。この酸化剤ガス流路６０は、燃料ガス流路４０と同様に構成されており、同一の構成要素には同一の参照符号を付してその詳細な説明は省略する。

【００２５】このように構成される第１の実施形態に係る燃料電池１０の動作について、以下に説明する。

【００２６】燃料電池１０内には、燃料ガスおよび酸化剤ガスが供給され、この燃料ガスが第１セパレータ１４の入口孔部３２ａ、３２ｂから燃料ガス流路４０に導入される。具体的には、図２に示すように、入口孔部３２ａから第１および第２主流路溝４２、４４に供給された燃料ガスは、第１セパレータ１４の面１４ａに沿って蛇行しながら重力方向に移動し、第３主流路溝４６に合流して出口孔部３６に移動する。その際、燃料ガス中に含まれる水素ガスが、単位燃料電池セル１２のアノード側電極２０に供給される。

【００２７】ここで、第１の実施形態では、入口孔部３２ａ、３２ｂから重力方向に向かって第１および第２補助流路溝４８、５０が設けられ、この第１および第２補助流路溝４８、５０を構成する直線部位５２、５４からそれぞれ分岐する合流部位５６ａ～５６ｄおよび５８ａ～５８ｄが第１～第３主流路溝４２、４４および４６の屈曲部に連通している。

【００２８】このため、第１～第３主流路溝４２、４４および４６からアノード側電極２０に水素ガスが供給されて燃料ガスが消費される際、第１および第２補助流路溝４８、５０から前記第１～第３主流路溝４２、４４および４６に燃料ガスが導入され、該第１～第３主流路溝４２、４４および４６内のガス流速を向上させることができる。これにより、ガス流の乱れを惹起させてガス拡散性を有効に上げるとともに、排水性の向上を図ることが可能になるという効果が得られる。

【００２９】しかも、第１および第２補助流路溝４８、５０に供給される燃料ガスが反応に供されるため、第１セパレータ１４の面１４ａにおける反応面積の増加が容易に図られる。さらに、第１および第２補助流路溝４８、５０から燃料ガスの補充が行われるため、第１セパレータ１４内におけるガスの圧損を有効に低減することが可能になる。

【００３０】さらにまた、第１および第２主流路溝４２、４４が合流して第３主流路溝４６となるため、溝本数が減少している。従って、第１および第２補助流路溝４８、５０の作用と相俟って、単位面積当たりの反応分子数が減少することがなく、アノード側電極２０の電極面全体で均一かつ円滑な反応が有効に遂行されるという利点がある。

【００３１】なお、第２セパレータ１６では、上記の第１セパレータ１４と同様の作用効果が得られるものであり、その詳細な説明は省略する。

【００３２】図４は、本発明の第２の実施形態に係る燃料電池を構成する第１セパレータ７０の正面説明図であり、図５は、第２セパレータ７２の正面説明図である。第１および第２セパレータ７０、７２は、それぞれの上部側に燃料ガスを通過させるための入口孔部７４ａ、７４ｂと、酸化剤ガスを通過させるための入口孔部７６ａ、７６ｂとを設ける一方、それぞれの下部側には、燃料ガスを通過させるための出口孔部７８と、酸化剤ガスを通過させるための出口孔部８０とが設けられる。

【００３３】図４に示すように、第１セパレータ７０の図示しないアノード側電極に対向する面７０ａには、燃

料ガス流路（第１ガス流路）８２が形成される。燃料ガス流路８２は、入口孔部７４ａから出口孔部７８に蛇行して連なる主流路溝８４と、前記入口孔部７４ａから前記主流路溝８４に合流する第１補助流路溝８６ａ～８６ｅと、入口孔部７４ｂから前記主流路溝８４に合流する第２補助流路溝８８ａ～８８ｆとを備える。

【００３４】第１補助流路溝８６ａ～８６ｅおよび第２補助流路溝８８ａ～８８ｆは、それぞれ入口孔部７４ａ、７４ｂに連通して直方向に延在する直線部位９０と、この直線部位９０の終端に連続して湾曲し、主流路溝８４の各屈曲部に連通する合流部位９２とを備えている。

【００３５】図５に示すように、第２セパレータ７２の図示しないカソード側電極に対向する面７２ａには、酸化剤ガス流路（第２ガス流路）１００が設けられる。この酸化剤ガス流路１００は、入口孔部７６ａと出口孔部８０とに蛇行して連なる主流路溝１０２と、前記入口孔部７６ａから前記主流路溝１０２に連なる第１補助流路溝１０４ａ～１０４ｅと、入口孔部７６ｂから前記主流路溝１０２に連なる第２補助流路溝１０６ａ～１０６ｆとを備える。なお、燃料ガス流路８２と同一の構成要素には同一の参照符号を付して、その詳細な説明は省略する。

【００３６】このように構成される第２の実施形態では、図４に示すように、第１セパレータ７０において、入口孔部７４ａから主流路溝８４に燃料ガスが供給されると、この燃料ガスは、前記主流路溝８４に沿って直方向に蛇行しながら出口孔部７８側に移動するとともに、その途上で図示しないアノード側電極に供給される。その際、個別に設けられている第１補助流路溝８６ａ～８６ｅおよび第２補助流路溝８８ａ～８８ｆを通って主流路溝８４の屈曲部に燃料ガスが導入される。

【００３７】このため、主流路溝８４内でガスが加速されて排水性が向上するとともに、ガスの圧損の低減が確実に遂行される。特に、第１補助流路溝８６ａ～８６ｅおよび第２補助流路溝８８ａ～８８ｆがそれぞれ個別に設けられるため、主流路溝８４の各屈曲部に対して燃料ガスを所定の流速で確実に導入させることができるという効果が得られる。なお、第２セパレータ７２においても、第１セパレータ７０と同様の効果が得られる。

【００３８】図６は、本発明の第３の実施形態に係る燃料電池１１０の要部分解斜視図である。なお、第１の実施形態に係る燃料電池１０と同一の構成要素には、同一の参照符号を付してその詳細な説明は省略する。

【００３９】燃料電池１１０は、単位燃料電池セル１２を狭持する第１および第２セパレータ１１２、１１４を備える。第１および第２セパレータ１１２、１１４の上部側には、燃料ガスを通過させるための入口孔部１１６と、酸化剤ガスを通過させるための入口孔部１１８とが設けられるとともに、前記第１および第２セパレータ１１２、１１４の下部側には、燃料ガスを通過させるための出口孔部１２０と、酸化剤ガスを通過させるための出口孔部１２２とが設けられる。

【００４０】図６および図７に示すように、第１セパレータ１１２は、アノード側電極２０に対向する面１１２ａに燃料ガス流路（第１ガス流路）１２４が形成される。燃料ガス流路１２４は、上部側の入口孔部１１６側から下方向（矢印Ａ方向）に向かって面方向一側部側（矢印Ｂ方向）に傾斜した後、屈曲して下方向に向かって面方向他側部側（矢印Ｃ方向）に傾斜して下部側の出口孔部１２０に連なる流路溝１２６ａと、この流路溝１２６ａとは反対側に傾斜して前記出口孔部１２０に連なる流路溝１２６ｂとを備える。この流路溝１２６ａ、１２６ｂは、第１セパレータ１１２の面中央部から面方向両側部側に向かって多列に配置されている。

【００４１】図６に示すように、第２セパレータ１１４は、カソード側電極２２に対向する面１１４ａに酸化剤ガス流路（第２ガス流路）１２８が形成される。この酸化剤ガス流路１２８は、燃料ガス流路１２４と同様に構成されており、同一の構成要素には同一の参照符号を付してその詳細な説明は省略する。なお、アノード側電極２０およびカソード側電極２２は、第１および第２ガスケット２４、２６に対し傾斜して配置されている。

【００４２】このように構成される第３の実施形態では、例えば、第１セパレータ１１２において、燃料ガスが入口孔部１１６から燃料ガス流路１２４に供給されると、この燃料ガスは、前記燃料ガス流路１２４を構成する各流路溝１２６ａに沿って一旦直方向に向かって矢印Ｂ方向に傾斜して自重により落下供給された後、直方向に向かって矢印Ｃ方向に傾斜して自重によって落下供給され、出口孔部１２０側に移動しながらアノード側電極２０に供給される。同様に、流路溝１２６ｂに導入された燃料ガスは、直方向に向かって矢印Ｃ方向に傾斜して移動した後、直方向に向かって矢印Ｂ方向に傾斜して出口孔部１２０側に移動しながらアノード側電極２０に供給される。

【００４３】このように、第３の実施形態では、燃料ガス流路１２４が全体として略葵形状の流路を構成する流路溝１２６ａ、１２６ｂを備えており、燃料ガスがこの流路溝１２６ａ、１２６ｂに沿って重力の作用下に自由落下しながらアノード側電極２０に供給される。従って、流路溝１２６ａ、１２６ｂに反応生成水が残留することがなく、簡単な構成で、この生成水の排出性が大幅に向上するという効果が得られる。

【００４４】なお、図７に示すように、燃料ガス流路１２４を構成する流路溝１２６ａ、１２６ｂの間には、矢印Ａ方向に指向して同一幅寸法を有する流路１３０が形成されているが、図８に示すように、第１セパレータ１１２の面１１２ａの中心に向かって上下方向から徐々に幅狭となる流路１３２ａ、１３２ｂを設けることができ

る。これにより、燃料ガス流路１２４における燃料ガスの流通性が一層向上することになる。

【００４５】図９は、本発明の第４の実施形態に係る燃料電池１４０の要部分解斜視図である。なお、第１の実施形態に係る燃料電池１０と同一の構成要素には、同一の参照符号を付してその詳細な説明は省略する。

【００４６】燃料電池１４０は、単位燃料電池セル１２を挟持する第１および第２セパレータ１４２、１４４を備える。第１および第２セパレータ１４２、１４４は、上部側に燃料ガスを通過させるための入口孔部１４６ａ、１４６ｂと、酸化剤ガスを通過させるための入口孔部１４８とが設けられ、その下部側には、燃料ガスを通過させるための出口孔部１５０と酸化剤ガスを通過させるための出口孔部１５２ａ、１５２ｂとが設けられる。

【００４７】図９および図１０に示すように、第１セパレータ１４２のアノード側電極２０に対向する面１４２ａには、入口孔部１４６ａ、１４６ｂと出口孔部１５０とを連通する燃料ガス流路（第１ガス流路）１５４が形成される。燃料ガス流路１５４は、入口孔部１４６ａと出口孔部１５０とを連通する第１流路溝１５６と、入口孔部１４６ｂと前記出口孔部１５０とを連通する第２流路溝１５８とを有する。第１および第２流路溝１５６、１５８は、それぞれ重力方向（矢印Ａ方向）に蛇行しながら設けられるとともに、面１４２ａの横方向（左右方向）にそれぞれ独立して分割形成されている。

【００４８】第２セパレータ１４４は、図９および図１１に示すように、カソード側電極２２に対向する面１４４ａに酸化剤ガス流路（第２ガス流路）１６０が形成される。酸化剤ガス流路１６０は、入口孔部１４８と出口孔部１５２ａとを連通して重力方向に向かって蛇行する第１流路溝１６２と、前記入口孔部１４８と出口孔部１５２ｂとを連通して重力方向に蛇行する第２流路溝１６４とを備えるとともに、前記第１および第２流路溝１６２、１６４は、幅方向に分割されかつ独立して設けられている。

【００４９】このように構成される第４の実施形態では、例えば、図１０に示すように、第１セパレータ１４２の入口孔部１４６ａ、１４６ｂから燃料ガス流路１５４に燃料ガスが供給されると、この燃料ガスは、それぞれ独立して設けられている第１および第２流路溝１５６、１５８に沿って重力方向に蛇行しながら移動する。このため、燃料ガスは、第１および第２流路溝１５６、１５８からアノード側電極２０に供給されるとともに、残余の燃料ガスが出口孔部１５０に排出される。

【００５０】一方、図１１に示すように、第２セパレータ１４４の入口孔部１４８に供給された酸化剤ガスは、それぞれ独立して設けられている第１および第２流路溝１６２、１６４に沿って重力方向に蛇行しながら移動する。従って、酸化剤ガスは、第１および第２流路溝１６２、１６４からカソード側電極２２に供給されるとともに、残余の酸化剤ガスが出口孔部１５２ａ、１５２ｂに排出される。

【００５１】このように、第４の実施形態では、例えば、第１セパレータ１４２の面１４２ａには、横方向に分割されかつそれぞれ独立して入口孔部１４６ａ、１４６ｂから出口孔部１５０に連通する第１および第２流路溝１５６、１５８が設けられている。このため、第１および第２流路溝１５６、１５８は、それぞれの流路長を一挙に短尺化することができ、燃料ガスの濃度分布のバラツキを小さくすることが可能になり、燃料電池１４０の発電性能を有効に向上させるという効果がある。

【００５２】図１２は、図１０に示す第１セパレータ１４２に代替して使用される本発明の第５の実施形態に係る燃料電池を構成する第１セパレータ１７０の正面説明図である。なお、第１セパレータ１４２と同一の構成要素には、同一の参照符号を付してその詳細な説明は省略する。

【００５３】この第１セパレータ１７０の面１７０ａには、燃料ガス流路１７２が形成され、この燃料ガス流路１７２が、それぞれ入口孔部１４６ａ、１４６ｂと出口孔部１５０とを連通する第１および第２流路溝１７４、１７６を有する。第１および第２流路溝１７４、１７６は、櫛子状に構成されており、横方向の流路と縦方向の流路とが互いに連通している。

【００５４】従って、第１セパレータ１７０では、それぞれ独立した第１および第２流路溝１７４、１７６を設けることにより、それぞれの流路長を短尺化することができ、前述した第１セパレータ１４２と同様の効果が得られることになる。

【００５５】

【発明の効果】本発明に係る燃料電池では、燃料ガスを供給する第１ガス流路または酸化剤ガスを供給する第２ガス流路の少なくとも一方が、ガス入口側からガス出口側に重力方向に蛇行して延なる主流路溝と、前記ガス入口側から重力方向に直線的に設けられて前記主流路溝に合流する補助流路溝とを備えている。このため、簡単な構成で、主流路溝から消費されるガスを有効に補充するとともに、ガス流速の減少を阻止し、排水性を確実に向上させることができる。しかも、ガスの圧損を低減する他、反応面積の拡大が容易に図られる。

【図面の簡単な説明】

【図１】本発明の第１の実施形態に係る燃料電池の要部分解斜視図である。

【図２】前記燃料電池を構成する第１セパレータの正面説明図である。

【図３】前記燃料電池を構成する第２セパレータの正面説明図である。

【図４】本発明の第２の実施形態に係る燃料電池を構成する第１セパレータの正面説明図である。

【図５】前記第２の実施形態に係る燃料電池を構成する

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第２セパレータの正面説明図である。

【図６】本発明の第３の実施形態に係る燃料電池の要部分解斜視図である。

【図７】前記第３の実施形態に係る燃料電池を構成する第１セパレータの正面説明図である。

【図８】図７に示すセパレータの変形例を示す正面説明図である。

【図９】本発明の第４の実施形態に係る燃料電池の要部分解斜視図である。

【図１０】前記第４の実施形態に係る燃料電池を構成する第１セパレータの正面説明図である。

【図１１】前記第４の実施形態に係る燃料電池を構成する第２セパレータの正面説明図である。

【図１２】本発明の第５の実施形態に係る燃料電池を構成する第１セパレータの正面説明図である。

【符号の説明】

１０．１１０．１４０…燃料電池

１２…単位燃料電池セル

１４．１６．７０．７２．１１２．１１４．１４２．１＊

12

＊４４．１７０…セパレータ

１８…電解質膜

２０…アノード側電極

２２…カソード側電極

３２ａ．３２ｂ．３４ａ．３４ｂ．７４ａ．７４ｂ．７６ａ．７６ｂ．１１６．１１８．１４６ａ．１４６ｂ．１４８…入口孔部

３６．３８．７８．８０．１２０．１２２．１５０．１５２ａ．１５２ｂ…出口孔部

４０．８２．１２４．１５４．１７２…燃料ガス流路

４２．４４．４６．８４．１０２…主流路溝

４８．５０．８６ａ～８６ｅ．８８ａ～８８ｆ．１０４ａ～１０４ｅ．１０６ａ～１０６ｆ…補助流路溝

５２．５４．９０…直線部位

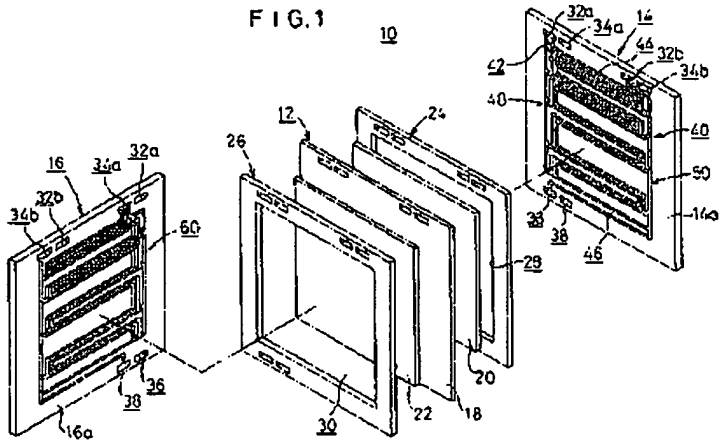
５６ａ～５６ｄ．５８ａ～５８ｄ．９２…台流部位

６０．１２８．１６０…酸化剤ガス流路

１２６ａ．１２６ｂ．１５６．１５８．１６２．１６４．１７４．１７６…流路溝

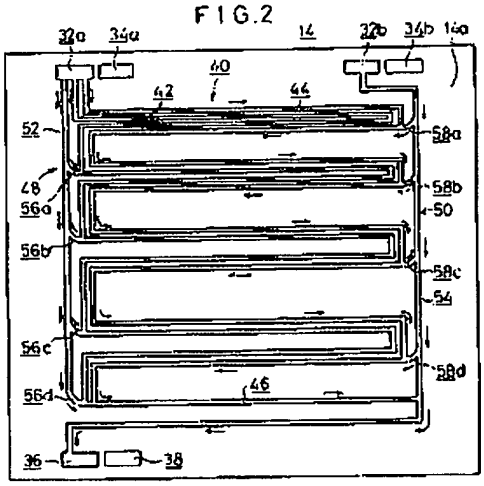
【図１】

FIG.1



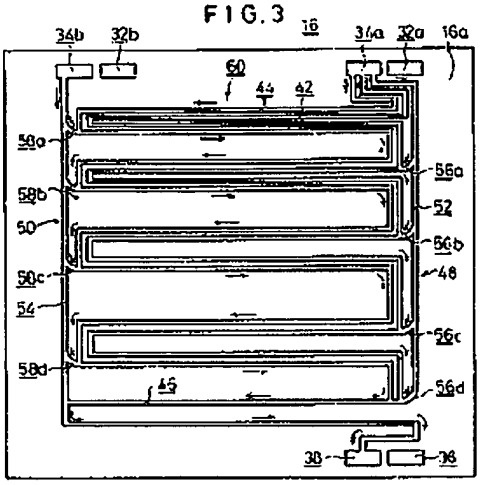
【図2】

FIG.2



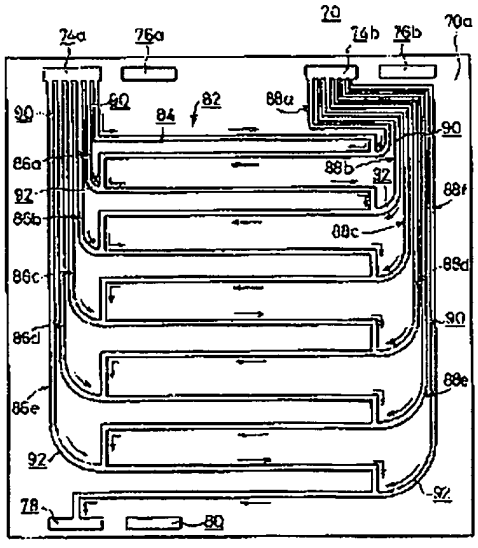
【図3】

FIG.3



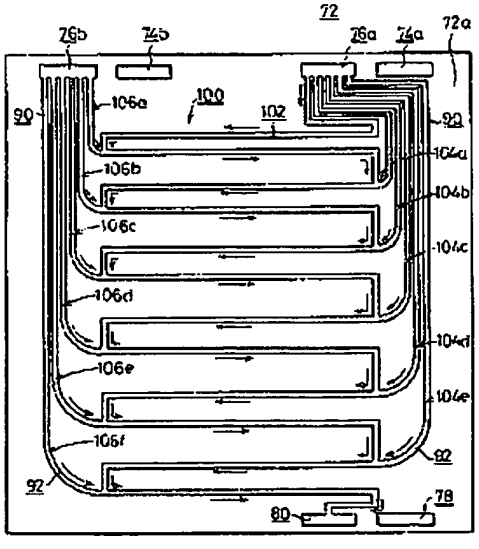
【図4】

FIG.4



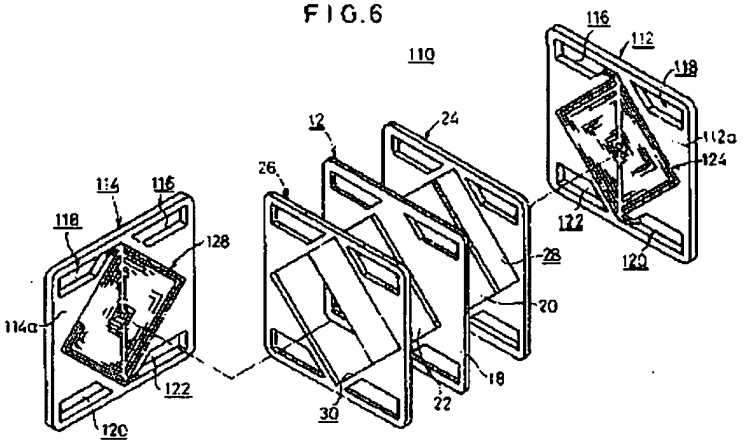
【図5】

FIG.5



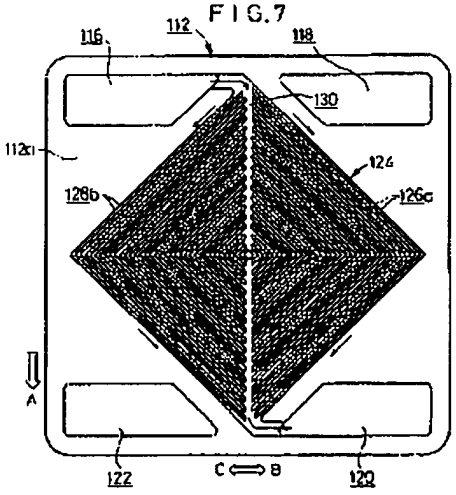
【図６】

FIG.6



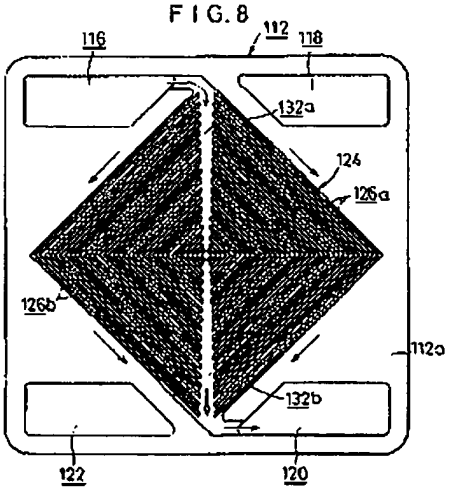
【図７】

FIG.7



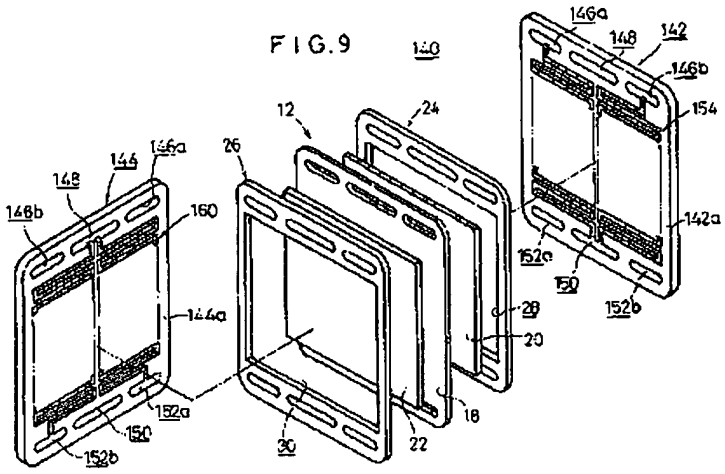
【図８】

FIG.8



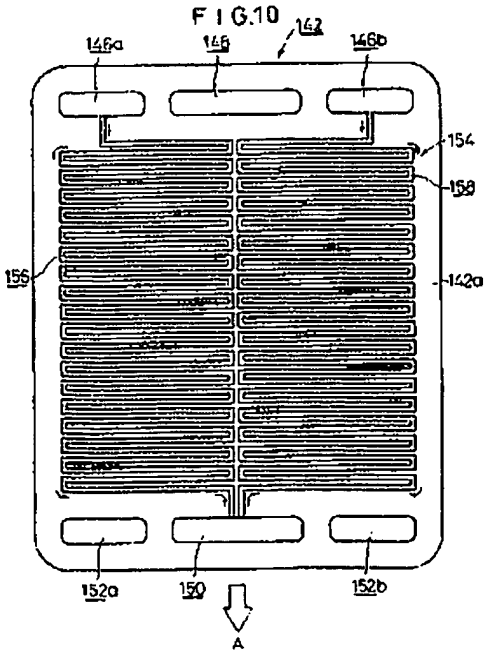
【図９】

FIG.9



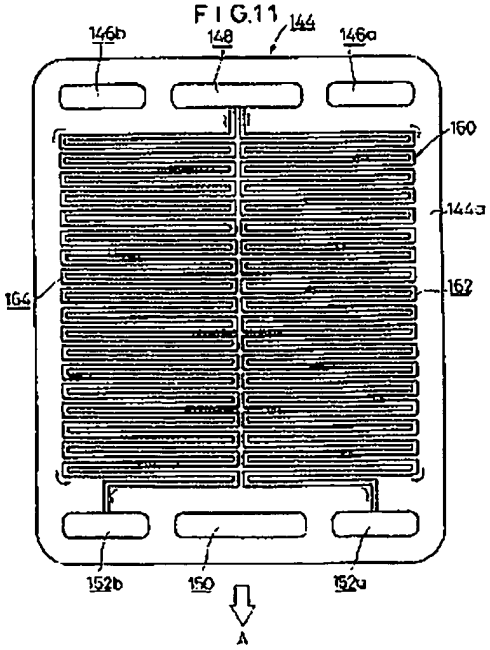
【図１０】

FIG.10



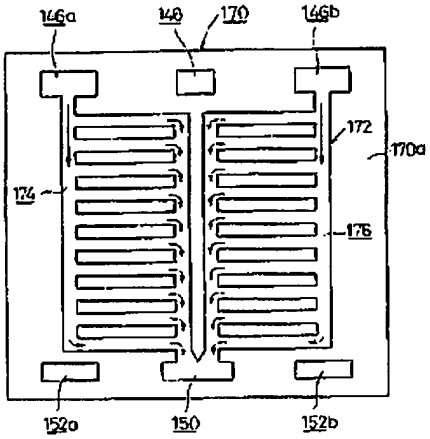
【図１１】

FIG.11



【図12】

FIG.12



PATENT ABSTRACTS OF JAPAN

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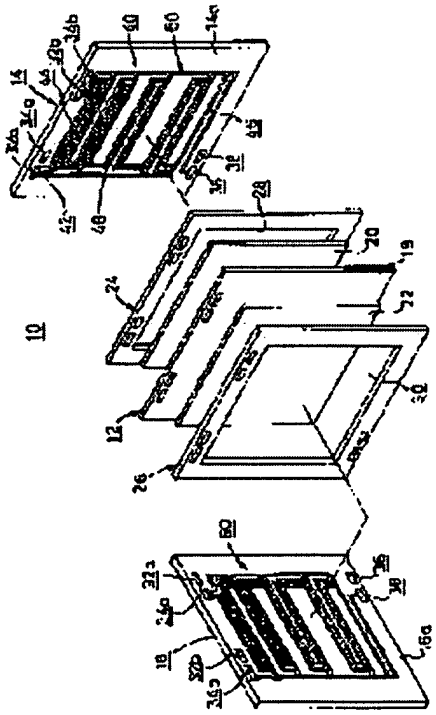
(71)Applicant : HONDA MOTOR CO LTD
(72)Inventor : KOSAKA YUICHIRO
SUZUKI SEIJI

(54) FUEL CELL

(57)Abstract:
PROBLEM TO BE SOLVED: To maintain proper gas diffusivity and water drainage with a simple constitution.
SOLUTION: The first and the second separators 14 and 16 have a fuel gas flow passage 40 and an oxidant gas flow passage 60. The fuel gas flow passage 40 has the first to the third main flow passage channels 42, 44 and 46 meandering from an inlet port 32a to an outlet port 36 for communication, and the first and the second auxiliary flow passage channels 48 and 50 joining the first to the third main flow passage channels 42, 44 and 46.



CLAIMS

[Claim(s)]
[Claim 1]A fuel cell comprising:
A unit fuel cell cell which comprises an anode lateral electrode and a cathode lateral electrode on both sides of an electrolyte.
Have the 1st and 2nd separators that pinch said unit fuel cell cell, and said 1st and 2nd separators,
Have the 1st and 2nd gas passagewaies that supply fuel gas and oxidant gas to said anode lateral electrode and said cathode lateral electrode, and at least said 1st or 2nd gas passageway, A mainstream way slot which lies in a zigzag line and stands in a row from the gas inlet side in a field of said 1st or 2nd separator in a gravity direction at the gas outlet side, and an auxiliary passage slot which has a unification part which joins said mainstream way slot while being linearly provided in a gravity direction from said gas inlet side.

[Claim 2]The fuel cell comprising according to claim 1:
A straight-line part which said auxiliary passage slot opens for free passage to said gas inlet side.
Said two or more unification parts which branch, respectively, curve from a way of said straight-line part, and are open for free passage to a flection of said mainstream way slot.

[Claim 3]In the fuel cell according to claim 1, said auxiliary passage slot, A fuel cell, wherein it has a straight-line part which is open for free passage to said gas inlet side, and said unification part which curves succeeding a termination of said straight-line part, and is open for free passage to a flection of said mainstream way slot and said two or more auxiliary passage slots are provided from said gas inlet side.
[Claim 4]A fuel cell, wherein there are more slot numbers by the side of said gas inlet than a slot number by the side of said gas outlet and said mainstream way slot is set up in a fuel cell given in any 1 paragraph of claims 1 thru/or 3.
[Claim 5]A fuel cell comprising:
A unit fuel cell cell which comprises an anode lateral electrode and a cathode lateral electrode on both sides of an electrolyte.
Have the 1st and 2nd separators that pinch said unit fuel cell cell, and said 1st and 2nd separators,
Have the 1st and 2nd gas passagewaies that supply fuel gas and oxidant gas to said anode lateral electrode and said cathode lateral electrode, and at least said 1st or 2nd gas passageway, A passage groove which is crooked, inclines in the plane direction other side portion side toward down, and stands in a row in the gas outlet side by the side of the lower part after inclining toward down in a field of said 1st or 2nd separator at the plane direction one side part side from the gas inlet side by the side of the upper part.

[Claim 6]A fuel cell, wherein said passage groove is arranged toward the plane direction side part side in the fuel cell according to claim 5 at multiple rows from a field center section of said 1st or 2nd separator.
[Claim 7]A fuel cell comprising:
A unit fuel cell cell which comprises an anode lateral electrode and a cathode lateral electrode on both sides of an electrolyte.
Have the 1st and 2nd separators that pinch said unit fuel cell cell, and said 1st and 2nd separators,
Have the 1st and 2nd gas passagewaies that supply fuel gas and oxidant gas to said anode lateral electrode and said cathode lateral electrode, and at least said 1st or 2nd gas passageway, Two or more passage grooves which are open for free passage while it is divided in a transverse direction in a field of said 1st or 2nd separator and moving in a zigzag direction in a gravity direction independently at the gas outlet side by the side of [the gas inlet side by the side of the upper part to] the lower part, respectively.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the fuel cell provided with the unit fuel cell cell which comprises an anode lateral electrode and a cathode lateral electrode on both sides of an electrolyte, and the 1st and 2nd separators that pinch said unit fuel cell cell.
[0002]
[Description of the Prior Art]For example, the polymer electrolyte fuel cell is constituted by pinching with a separator the unit fuel cell cell constituted by the both sides of the electrolyte which consists of a polymers ion-exchange membrane (cation exchange membrane) by an opposite **(ing) an anode lateral electrode and a cathode lateral electrode, respectively.
Usually, only a predetermined number laminates said unit fuel cell cell and said separator, and it is used as a fuel cell stack.

[0003]In this kind of fuel cell, on a catalyzer electrode, the fuel gas supplied to the anode lateral electrode, for example, hydrogen gas, is hydrogen-ion-ized, and it moves to the cathode lateral electrode side via the electrolyte humidified moderately. The electron produced in the meantime is taken out by the external circuit, and is used as electrical energy of a direct current. Since oxidant gas, for example, oxygen gas, or air is supplied, in this cathode lateral electrode, said hydrogen ion, an electron, and oxygen react to a cathode lateral electrode, and water is generated.
[0004]By the way, in order to supply fuel gas and oxidant gas to an anode lateral electrode and a cathode lateral electrode, respectively, Usually, while the porous layer which has conductivity in a catalyzer electrode layer (electrode surface), for example, porosity carbon paper, is pinched with a separator, 1 or two or more gas passagewaies which were set as the uniform width dimension are provided in the field where each separator counters mutually.
[0005]
[Problem(s) to be Solved by the Invention]However, in the above-mentioned composition, since fuel gas and oxidant gas which were supplied to the gas passageway are consumed in the field of a separator, the molecularity per [in near the exit of this gas passageway] unit area will decrease compared with the entrance side of this gas passageway. The problem that a reaction in an electrode surface becomes uneven and cell performance becomes unstable by this is pointed out.
[0006]In a gas passageway, the moisture generated by hydrometeor and the reaction may exist in the state of a fluid (water). When this water is accumulated in a porous layer, the diffusibility to the catalyzer electrode layer of fuel gas and oxidant gas falls, and there is a possibility that cell performance may get remarkably bad.
[0007]Then, for example, as indicated by JP,6-267564,A, A fuel separator with the fuel passage

which supplies fuel to an anode pole, and an oxidizer separator with the oxidizer passage which supplies an oxidizer to a cathode pole are provided, The depth of the oxidizer passage of said oxidizer separator or the fuel cell of width which made either small gradually along the downstream channel region from the upper channel region of the oxidizer at least is known.

[0008]However, in the above-mentioned conventional technology, the depth of the upper channel region of an oxidizer passage will become large, and the separator itself will become fairly thick. Thereby, the problem that the miniaturization of the whole fuel cell is not carried out easily is pointed out. And there is a problem that the processing operation which makes the depth small gradually toward the lower stream will become very complicated from the upper stream of a gas passageway.

[0009]This invention solves this kind of problem.

The purpose is easy composition and is providing the fuel cell which can secure good gas diffusion nature and wastewater nature.

[0010]

[Means for Solving the Problem]In a fuel cell concerning this invention, while having the 1st and 2nd gas passagewaies that supply fuel gas and oxidant gas to an anode lateral electrode and a cathode lateral electrode, the 1st and 2nd separators that pinch a unit fuel cell cell, This 1st or 2nd gas passageway is provided with a mainstream way slot which lies in a zigzag line and stands in a row in a gravity direction from the gas inlet side at the gas outlet side, and an auxiliary passage slot which is linearly established in a gravity direction from this gas inlet side, and joins said mainstream way slot at least.

[0011]For this reason, when gas which flows through a mainstream way slot toward the gas outlet side from the gas inlet side is consumed, gas is supplied from an auxiliary passage slot which joins this mainstream way slot, and reduction of a gas flow rate in said mainstream way slot can be prevented effectively. Therefore, it becomes possible to accelerate gas in a mainstream way slot, and for a gas flow rate to become quick, and to raise wastewater nature certainly. And while being able to reduce a pressure loss of gas within a field of the 1st or 2nd separator, gas which flows through an auxiliary passage slot can react, and an increase in a reaction surface product within a field of said 1st or 2nd separator can be aimed at.

[0012]Here, an auxiliary passage slot is provided with a straight-line part which is open for free passage to the gas inlet side, and two or more unification parts which branch, respectively, curve from a way of this straight-line part, and are open for free passage to a flection of a mainstream way slot in this invention. For this reason, it can prevent effectively that the rate of flow of gas which flows through an auxiliary passage slot falls, and gas can be smoothly supplied to each flection of a mainstream way slot at the desired rate of flow.

[0013]While an auxiliary passage slot is provided with a straight-line part which is open for free passage to the gas inlet side, and a unification part which curves succeeding a termination of this straight-line part, and is open for free passage to a flection of a mainstream way slot, said two or more auxiliary passage slots are provided. Therefore, gas accelerated from each auxiliary passage slot in a mainstream way slot can be supplied certainly, and it becomes possible to raise wastewater nature in this mainstream way Mizouchi.

[0014]More mainstream way slots than a slot number by the side of a gas outlet are set up in a slot number by the side of a gas inlet. Thereby, since a slot number decreases with consumption of gas, molecularity per unit area by the side of a gas outlet cannot decrease compared with the gas inlet side, and equalization of a reaction in an electrode surface can be attained.

[0015][further again / this invention / at least / in a field of the 1st or 2nd separator] the 1st or 2nd gas passageway, After inclining in the plane direction one side part side toward down from the

gas inlet side by the side of the upper part, it has a passage groove which is crooked, inclines in the plane direction other side portion side toward down, and stands in a row in the gas outlet side by the side of the lower part. Therefore, while providing the 1st or 2nd gas passageway along an electrode surface to inside of a field of the 1st or 2nd separator, a passage groove inclines toward down and produced water in said passage groove carries out free fall to the gas outlet side under an operation of gravity. Thereby, the eccritic nature of produced water in a passage groove improves substantially.

[0016]Here, a passage groove is arranged toward the plane direction side part side at multiple rows from a field center section of the 1st or 2nd separator. For this reason, it becomes possible to supply gas uniformly and certainly to an electrode surface.

[0017]In this invention, it has two or more passage grooves which are open for free passage while the 1st or 2nd gas passageway is divided into a transverse direction in a field of the 1st or 2nd separator and winds in a gravity direction independently at least at the gas outlet side by the side of [the gas inlet side by the side of the upper part to] the lower part, respectively. A flute length of each passage groove from the gas inlet side to the gas outlet side can be short-length-ized at once by this, and the eccritic nature of water generated in said passage groove improves substantially. And by short-length-izing a flute length of each passage groove, variation in concentration distribution of oxidant gas or fuel gas can be lessened, and it becomes possible to raise power generation performance of a fuel cell effectively.

[0018]

[Embodiment of the Invention]Drawing 1 is an important section exploded perspective view of the fuel cell 10 concerning a 1st embodiment of this invention. It has the unit fuel cell cell 12 and the 1st and 2nd separators 14 and 16 that pinch this unit fuel cell cell 12, two or more sets of these are laminated if needed, and the fuel cell 10 constitutes the fuel cell stack.

[0019]The unit fuel cell cell 12 is provided with the following.

Solid polyelectrolyte membrane 18.

The anode lateral electrode 20 and the cathode lateral electrode 22 which are allocated on both sides of this electrolyte membrane 18.

[0020]They are formed in the both sides of the unit fuel cell cell 12 by the 1st and 2nd gaskets 24 and 26, and said 1st gasket 24, While it has the big opening 28 for storing the anode lateral electrode 20, said 2nd gasket 26 has the big opening 30 for storing the cathode lateral electrode 22. The unit fuel cell cell 12 and the 1st and 2nd gaskets 24 and 26 are pinched with the 1st and 2nd separators 14 and 16.

[0021]As shown in drawing 1 - drawing 3, the 1st and 2nd separators 14 and 16 are provided with the following.

The inlet-port parts 32a and 32b for passing fuel gas, such as hydrogen gas, to each upper part side.

The inlet-port parts 34a and 34b for passing the oxidant gas which is oxygen or air.

The outlet hole part 36 for passing fuel gas and the outlet hole part 38 for passing oxidant gas are formed in the lower part side of the 1st separator 14.

[0022]As shown in drawing 2, the fuel gas flow route (the 1st gas passageway) 40 which opens the inlet-port parts 32a and 32b and the outlet hole part 36 for free passage is formed in the field 14a which counters the anode lateral electrode 20 of the 1st separator 14. The fuel gas flow route 40 is provided with the following.

The 1st and 2nd mainstream way slots 42 and 44 which are open for free passage in the inlet-port part 32a, and lie in a zigzag line toward a gravity direction (the direction of arrow A) in the field 14a.

The 3rd mainstream way slot 46 which is open for free passage in the outlet hole part 36 after said

1st and 2nd mainstream way slots 42 and 44 join in one.
The 1st and 2nd auxiliary passage slots 48 and 50 which are linearly established in a gravity direction from the inlet-port parts 32a and 32b, and join said 1st [the] - the 3rd mainstream way slots 42, 44, and 46.

[0023]the [the 1st and] -- the 2 mainstream way slots 42 and 44 go to down (the direction of arrow A) from the upper part side of the 1st separator 14 -- mutual alienation -- being constituted so that an interval and each passage groove interval may become large, and joining mutually by the outlet hole part 36 side -- the -- the 3 mainstream way slots 46 are formed. The 1st and 2nd auxiliary passage slots 48 and 50 are provided with the following.
The straight-line parts 52 and 54 which are open for free passage in the inlet-port parts 32a and 32b, and extend in the direction of arrow A.
Two or more unification parts 56a-56d and 58a-58d which branches, respectively, curves from the way of said straight-line parts 52 and 54, and is open for free passage to the flection of the 1st and 2nd mainstream way slots 42 and 44

[0024]As shown in drawing 3, the oxidant gas passage (the 2nd gas passageway) 60 which opens the inlet-port parts 34a and 34b and the outlet hole part 38 for free passage is formed in the field 16a which counters the cathode lateral electrode 22 of the 2nd separator 16. This oxidant gas passage 60 is constituted like the fuel gas flow route 40, gives the same reference mark to the same component, and omits that detailed explanation.
[0025]Operation of the fuel cell 10 concerning a 1st embodiment constituted in this way is explained below.
[0026]Fuel gas and oxidant gas are supplied in the fuel cell 10, and this fuel gas is introduced into the fuel gas flow route 40 from the inlet-port parts 32a and 32b of the 1st separator 14. As shown in drawing 2, the fuel gas supplied to the 1st and 2nd mainstream way slots 42 and 44 from the inlet-port part 32a moves to a gravity direction, moving in a zigzag direction along the field 14a of the 1st separator 14, joins the 3rd mainstream way slot 46, and, specifically, moves to the outlet hole part 36. In that case, the hydrogen gas contained in fuel gas is supplied to the anode lateral electrode 20 of the unit fuel cell cell 12.
[0027]By a 1st embodiment, the 1st and 2nd auxiliary passage slots 48 and 50 are formed toward a gravity direction here from the inlet-port parts 32a and 32b, The unification parts 56a-56d which branch, respectively from the straight-line parts 52 and 54 which constitute these 1st and 2nd auxiliary passage slots 48 and 50, and 58a-58d are open for free passage to the flection of the 1st - the 3rd mainstream way slots 42, 44, and 46.
[0028]For this reason, when hydrogen gas is supplied to the anode lateral electrode 20 from the 1st - the 3rd mainstream way slots 42, 44, and 46 and fuel gas is consumed, Fuel gas is introduced into said 1st [the] - the 3rd mainstream way slots 42, 44, and 46 from the 1st and 2nd auxiliary passage slots 48 and 50, and the gas flow rate in these 1st-3rd mainstream way slots 42 and 44 and 46 can be raised. While making disorder of a gas stream cause and raising gas diffusion nature effectively by this, the effect of becoming possible to aim at improvement in wastewater nature is acquired.
[0029]And since a reaction is presented with the fuel gas supplied to the 1st and 2nd auxiliary passage slots 48 and 50, the increase in the reaction surface product in the field 14a of the 1st separator 14 is achieved easily. Since the supplement of fuel gas is performed from the 1st and 2nd auxiliary passage slots 48 and 50, it becomes possible to reduce effectively the pressure loss of the gas in the 1st separator 14.
[0030]Since the 1st and 2nd mainstream way slots 42 and 44 join and it becomes the 3rd

mainstream way slot 46 further again, the slot number is decreasing. Therefore, the molecularity per unit area does not decrease conjointly with an operation of the 1st and 2nd auxiliary passage slots 48 and 50, and there is an advantage that a uniform and smooth reaction is carried out effectively in the whole electrode surface of the anode lateral electrode 20.

[0031]In the 2nd separator 16, the same operation effect as the 1st above-mentioned separator 14 is obtained, and the detailed explanation is omitted.

[0032]Drawing 4 is a transverse-plane explanatory view of the 1st separator 70 that constitutes the fuel cell concerning a 2nd embodiment of this invention, and drawing 5 is a transverse-plane explanatory view of the 2nd separator 72. The inlet-port parts 74a and 74b for the 1st and 2nd separators 70 and 72 to pass fuel gas to each upper part side, While forming the inlet-port parts 76a and 76b for passing oxidant gas, the outlet hole part 78 for passing fuel gas and the outlet hole part 80 for passing oxidant gas are formed in each lower part side.

[0033]As shown in drawing 4, the fuel gas flow route (the 1st gas passageway) 82 is formed in the field 70a which counters the anode lateral electrode which the 1st separator 70 does not illustrate. The fuel gas flow route 82 is provided with the following.

The mainstream way slot 84 which lies in a zigzag line and stands in a row in the outlet hole part 78 from the inlet-port part 74a.

The 1st auxiliary passage slots 86a-86e which join said mainstream way slot 84 from said inlet-port part 74a.

The 2nd auxiliary passage slots 88a-88f which join said mainstream way slot 84 from the inlet-port part 74b.

[0034]The 1st auxiliary passage slots 86a-86e and the 2nd auxiliary passage slots 88a-88f are provided with the following.

The straight-line part 90 which is open for free passage in the inlet-port parts 74a and 74b, respectively, and extends in a gravity direction.

The unification part 92 which curves succeeding the termination of this straight-line part 90, and is open for free passage to each flection of the mainstream way slot 84.

[0035]As shown in drawing 5, the oxidant gas passage (the 2nd gas passageway) 100 is established in the field 72a which counters the cathode lateral electrode which the 2nd separator 72 does not illustrate. This oxidant gas passage 100 is provided with the following.

The mainstream way slot 102 which lies in a zigzag line and stands in a row in the inlet-port part 76a and the outlet hole part 80.

The 1st auxiliary passage slots 104a-104e which stand in a row into said mainstream way slot 102 from said inlet-port part 76a.

The 2nd auxiliary passage slots 106a-106f which stand in a row into said mainstream way slot 102 from the inlet-port part 76b.

The same reference mark is given to the same component as the fuel gas flow route 82, and the detailed explanation is omitted.

[0036]As shown [a 2nd embodiment constituted in this way] in drawing 4, when fuel gas is supplied to the mainstream way slot 84 from the inlet-port part 74a in the 1st separator 70, this fuel gas, While moving to the outlet hole part 78 side, moving in a zigzag direction in a gravity direction along said mainstream way slot 84, the anode lateral electrode which is not illustrated on the way is supplied. In that case, fuel gas is introduced into the flection of the mainstream way slot 84 through the 1st auxiliary passage slots 86a-86e and the 2nd auxiliary passage slots 88a-88f which are provided individually.

[0037]For this reason, while gas is accelerated in the mainstream way slot 84 and wastewater

nature improves, reduction of the pressure loss of gas is carried out certainly. Since the 1st auxiliary passage slots 86a-86e and the 2nd auxiliary passage slots 88a-88f are formed especially individually, respectively, the effect of the ability to make fuel gas introducing certainly at the predetermined rate of flow to each flection of the mainstream way slot 84 is acquired. Also in the 2nd separator 72, the same effect as the 1st separator 70 is acquired.

[0038]Drawing 6 is an important section exploded perspective view of the fuel cell 110 concerning a 3rd embodiment of this invention. The same reference mark is given to the same component as the fuel cell 10 concerning a 1st embodiment, and the detailed explanation is omitted to it.

[0039]The fuel cell 110 is provided with the 1st and 2nd separators 112 and 114 that pinch the unit fuel cell cell 12. To the upper part side of the 1st and 2nd separators 112 and 114. While the inlet-port part 116 for passing fuel gas and the inlet-port part 118 for passing oxidant gas are formed, The outlet hole part 120 for passing fuel gas and the outlet hole part 122 for passing oxidant gas are formed in the lower part side of said 1st and 2nd separators 112 and 114.

[0040]As shown in drawing 6 and drawing 7, the fuel gas flow route (the 1st gas passageway) 124 is formed in the field 112a where the 1st separator 112 counters the anode lateral electrode 20. The fuel gas flow route 124 is provided with the following.

The passage groove 126a which is crooked, inclines toward down in the plane direction other side portion side (the direction of arrow C), and stands in a row in the outlet hole part 120 by the side of the lower part after inclining toward down (the direction of arrow A) in the plane direction one side part side (the direction of arrow B) from the inlet-port part 116 side by the side of the upper part. The passage groove 126b which inclines in an opposite hand in this passage groove 126a, and stands in a row in said outlet hole part 120.

These passage grooves 126a and 126b are arranged toward the plane direction side part side at multiple rows from the field center section of the 1st separator 112.

[0041]As shown in drawing 6, the oxidant gas passage (the 2nd gas passageway) 128 is formed in the field 114a where the 2nd separator 114 counters the cathode lateral electrode 22. This oxidant gas passage 128 is constituted like the fuel gas flow route 124, gives the same reference mark to the same component, and omits that detailed explanation. To the 1st and 2nd gaskets 24 and 26, the anode lateral electrode 20 and the cathode lateral electrode 22 incline, and are arranged.

[0042]When fuel gas is supplied to the fuel gas flow route 124 from the inlet-port part 116, in a 3rd embodiment constituted in this way, for example in the 1st separator 112 this fuel gas, After it once inclined in the direction of arrow B toward the gravity direction along each passage groove 126a which constitutes said fuel gas flow route 124 and dropping feed was carried out by prudence, It inclines in the direction of arrow C toward a gravity direction, and the anode lateral electrode 20 is supplied, dropping feed being carried out by prudence and moving to the outlet hole part 120 side with it. Similarly, the fuel gas introduced into the passage groove 126b is supplied to the anode lateral electrode 20, inclining in the direction of arrow B toward a gravity direction, and moving to the outlet hole part 120 side, after inclining and moving in the direction of arrow C toward a gravity direction.

[0043]Thus, in a 3rd embodiment, the fuel gas flow route 124 is provided with the passage grooves 126a and 126b which constitute an approximately rhombus-like channel as a whole, and while fuel gas carries out free fall under an operation of gravity along these passage grooves 126a and 126b, the anode lateral electrode 20 is supplied. Therefore, produced water does not remain to the passage grooves 126a and 126b, and the effect that the eccritic nature of this produced water improves substantially is acquired with easy composition.

[0044]As shown in drawing 7, among the passage grooves 126a and 126b which constitute the fuel gas flow route 124, the channel 130 which directs in the direction of arrow A and has a same width dimension is formed, but. As shown in drawing 8, the channels 132a and 132b which become

narrow gradually from a sliding direction toward the center of the field 112a of the 1st separator 112 can be formed. By this, the distributivity of the fuel gas in the fuel gas flow route 124 will improve further.

[0045]Drawing 9 is an important section exploded perspective view of the fuel cell 140 concerning a 4th embodiment of this invention. The same reference mark is given to the same component as the fuel cell 10 concerning a 1st embodiment, and the detailed explanation is omitted to it.

[0046]The fuel cell 140 is provided with the 1st and 2nd separators 142 and 144 that pinch the unit fuel cell cell 12. The 1st and 2nd separators 142 and 144, The inlet-port parts 146a and 146b for passing fuel gas and the inlet-port part 148 for passing oxidant gas are formed in the upper part side, and the outlet hole parts 152a and 152b for passing the outlet hole part 150 and oxidant gas for passing fuel gas are formed in the lower part side.

[0047]As shown in drawing 9 and drawing 10, the fuel gas flow route (the 1st gas passageway) 154 which opens the inlet-port parts 146a and 146b and the outlet hole part 150 for free passage is formed in the field 142a which counters the anode lateral electrode 20 of the 1st separator 142. The fuel gas flow route 154 has the 2nd passage groove 158 that opens for free passage the 1st passage groove 156 that opens the inlet-port part 146a and the outlet hole part 150 for free passage, and the inlet-port part 146b and said outlet hole part 150. While the 1st and 2nd passage grooves 156 and 158 are formed moving in a zigzag direction in a gravity direction (the direction of arrow A), respectively, the split shape of them is independently carried out to the transverse direction (longitudinal direction) of the field 142a, respectively.

[0048]As the 2nd separator 144 is shown in drawing 9 and drawing 11, the oxidant gas passage (the 2nd gas passageway) 160 is formed in the field 144a which counters the cathode lateral electrode 22. The 1st passage groove 162 that the oxidant gas passage 160 opens the inlet-port part 148 and the outlet hole part 152a for free passage, and winds toward a gravity direction, While having the 2nd passage groove 164 that opens said inlet-port part 148 and the outlet hole part 152b for free passage, and winds in a gravity direction, said 1st and 2nd passage grooves 162 and 164 are divided crosswise, and are provided independently.

[0049]In a 4th embodiment constituted in this way, as shown in drawing 10, for example, If fuel gas is supplied to the fuel gas flow route 154 from the inlet-port parts 146a and 146b of the 1st separator 142, this fuel gas will move, moving in a zigzag direction in a gravity direction along the 1st and 2nd passage grooves 156 and 158 provided independently, respectively. For this reason, while fuel gas is supplied to the anode lateral electrode 20 from the 1st and 2nd passage grooves 156 and 158, residual fuel gas is discharged by the outlet hole part 150.

[0050]On the other hand, as shown in drawing 11, the oxidant gas supplied to the inlet-port part 148 of the 2nd separator 144 moves, moving in a zigzag direction in a gravity direction along the 1st and 2nd passage grooves 162 and 164 provided independently, respectively. Therefore, while oxidant gas is supplied to the cathode lateral electrode 22 from the 1st and 2nd passage grooves 162 and 164, residual oxidant gas is discharged by the outlet hole parts 152a and 152b.

[0051]Thus, in a 4th embodiment, the 1st and 2nd passage grooves 156 and 158 that are divided into a transverse direction and are open for free passage in the outlet hole part 150 from the inlet-port parts 146a and 146b independently, respectively are established in the field 142a of the 1st separator 142, for example. For this reason, the 1st and 2nd passage grooves 156 and 158 can short-length-ize each channel length at once, and it becomes possible to make small variation in the concentration distribution of fuel gas, and is effective in raising the power generation performance of the fuel cell 140 effectively.

[0052]Drawing 12 is a transverse-plane explanatory view of the 1st separator 170 that constitutes the fuel cell concerning a 5th embodiment of this invention used substituting the 1st separator 142 shown in drawing 10. The same reference mark is given to the same component as the 1st

separator 142, and the detailed explanation is omitted to it.
[0053]The fuel gas flow route 172 is formed in the field 170a of this 1st separator 170, and this fuel gas flow route 172 has the 1st and 2nd passage grooves 174 and 176 that open the inlet-port parts 146a and 146b and the outlet hole part 150 for free passage, respectively. The 1st and 2nd passage grooves 174 and 176 are constituted in the shape of a ladder, and the lateral channel and the channel of a lengthwise direction are mutually open for free passage.
[0054]Therefore, in the 1st separator 170, by forming the 1st and 2nd passage grooves 174 and 176 that became independent, respectively, each channel length can be short-length-ized and the same effect as the 1st separator 142 mentioned above will be acquired.
[0055]
[Effect of the Invention]The mainstream way slot where at least one side of the 2nd gas passageway that supplies the 1st gas passageway that supplies fuel gas, or oxidant gas in the fuel cell concerning this invention moves in a zigzag direction and stands in a row in the gas outlet side from the gas inlet side in a gravity direction, It has the auxiliary passage slot which is linearly established in a gravity direction from said gas inlet side, and joins said mainstream way slot. For this reason, while replacing with easy composition effectively the gas consumed from a mainstream way slot, reduction in a gas flow rate can be prevented and wastewater nature can be certainly raised with it. And the pressure loss of gas is reduced and also expansion of a reaction surface product is achieved easily.

[Translation done.]

TECHNICAL FIELD

[Field of the Invention]This invention relates to the fuel cell provided with the unit fuel cell cell which comprises an anode lateral electrode and a cathode lateral electrode on both sides of an electrolyte, and the 1st and 2nd separators that pinch said unit fuel cell cell.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention]The mainstream way slot where at least one side of the 2nd gas passageway that supplies the 1st gas passageway that supplies fuel gas, or oxidant gas in the fuel cell concerning this invention moves in a zigzag direction and stands in a row in the gas outlet side from the gas inlet side in a gravity direction, It has the auxiliary passage slot which is linearly established in a gravity direction from said gas inlet side, and joins said mainstream way slot. For this reason, while replacing with easy composition effectively the gas consumed from a mainstream way slot, reduction in a gas flow rate can be prevented and wastewater nature can be certainly raised with it. And the pressure loss of gas is reduced and also expansion of a reaction surface product is achieved easily.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]However, in the above-mentioned composition, since fuel gas and oxidant gas which were supplied to the gas passageway are consumed in the field of a separator, the molecularity per [in near the exit of this gas passageway] unit area will decrease compared with the entrance side of this gas passageway. The problem that a reaction in an electrode surface becomes uneven and cell performance becomes unstable by this is pointed out.
[0006]In a gas passageway, the moisture generated by hydrometeor and the reaction may exist in the state of a fluid (water). When this water is accumulated in a porous layer, the diffusibility to the catalyzer electrode layer of fuel gas and oxidant gas falls, and there is a possibility that cell performance may get remarkably bad.
[0007]Then, for example, as indicated by JP,6-267564,A, A fuel separator with the fuel passage which supplies fuel to an anode pole, and an oxidizer separator with the oxidizer passage which supplies an oxidizer to a cathode pole are provided, The depth of the oxidizer passage of said oxidizer separator or the fuel cell of width which made either small gradually along the downstream channel region from the upper channel region of the oxidizer at least is known.
[0008]However, in the above-mentioned conventional technology, the depth of the upper channel region of an oxidizer passage will become large, and the separator itself will become fairly thick. Thereby, the problem that the miniaturization of the whole fuel cell is not carried out easily is pointed out. And there is a problem that the processing operation which makes the depth small gradually toward the lower stream will become very complicated from the upper stream of a gas passageway.
[0009]This invention solves this kind of problem.
The purpose is easy composition and is providing the fuel cell which can secure good gas diffusion nature and wastewater nature.

[Translation done.]

MEANS

[Means for Solving the Problem]In a fuel cell concerning this invention, while having the 1st and 2nd gas passagewaies that supply fuel gas and oxidant gas to an anode lateral electrode and a cathode lateral electrode, the 1st and 2nd separators that pinch a unit fuel cell cell, This 1st or 2nd gas passageway is provided with a mainstream way slot which lies in a zigzag line and stands in a row in a gravity direction from the gas inlet side at the gas outlet side, and an auxiliary passage slot which is linearly established in a gravity direction from this gas inlet side, and joins said mainstream way slot at least.
[0011]For this reason, when gas which flows through a mainstream way slot toward the gas outlet side from the gas inlet side is consumed, gas is supplied from an auxiliary passage slot which joins this mainstream way slot, and reduction of a gas flow rate in said mainstream way slot can be prevented effectively. Therefore, it becomes possible to accelerate gas in a mainstream way slot, and for a gas flow rate to become quick, and to raise wastewater nature certainly. And while being able to reduce a pressure loss of gas within a field of the 1st or 2nd separator, gas which flows through an auxiliary passage slot can react, and an increase in a reaction surface product within a field of said 1st or 2nd separator can be aimed at.
[0012]Here, an auxiliary passage slot is provided with a straight-line part which is open for free passage to the gas inlet side, and two or more unification parts which branch, respectively, curve from a way of this straight-line part, and are open for free passage to a flection of a mainstream way slot in this invention. For this reason, it can prevent effectively that the rate of flow of gas which flows through an auxiliary passage slot falls, and gas can be smoothly supplied to each flection of a mainstream way slot at the desired rate of flow.
[0013]While an auxiliary passage slot is provided with a straight-line part which is open for free passage to the gas inlet side, and a unification part which curves succeeding a termination of this straight-line part, and is open for free passage to a flection of a mainstream way slot, said two or more auxiliary passage slots are provided. Therefore, gas accelerated from each auxiliary passage slot in a mainstream way slot can be supplied certainly, and it becomes possible to raise wastewater nature in this mainstream way Mizouchi.
[0014]More mainstream way slots than a slot number by the side of a gas outlet are set up in a slot number by the side of a gas inlet. Thereby, since a slot number decreases with consumption of gas, molecularity per unit area by the side of a gas outlet cannot decrease compared with the gas inlet side, and equalization of a reaction in an electrode surface can be attained.
[0015][further again / this invention / at least / in a field of the 1st or 2nd separator] the 1st or 2nd gas passageway, After inclining in the plane direction one side part side toward down from the gas inlet side by the side of the upper part, it has a passage groove which is crooked, inclines in the plane direction other side portion side toward down, and stands in a row in the gas outlet side by

the side of the lower part. Therefore, while providing the 1st or 2nd gas passageway along an electrode surface to inside of a field of the 1st or 2nd separator, a passage groove inclines toward down and produced water in said passage groove carries out free fall to the gas outlet side under an operation of gravity. Thereby, the eccritic nature of produced water in a passage groove improves substantially.

[0016]Here, a passage groove is arranged toward the plane direction side part side at multiple rows from a field center section of the 1st or 2nd separator. For this reason, it becomes possible to supply gas uniformly and certainly to an electrode surface.

[0017]In this invention, it has two or more passage grooves which are open for free passage while the 1st or 2nd gas passageway is divided into a transverse direction in a field of the 1st or 2nd separator and winds in a gravity direction independently at least at the gas outlet side by the side of [the gas inlet side by the side of the upper part to] the lower part, respectively. A flute length of each passage groove from the gas inlet side to the gas outlet side can be short-length-ized at once by this, and the eccritic nature of water generated in said passage groove improves substantially. And by short-length-izing a flute length of each passage groove, variation in concentration distribution of oxidant gas or fuel gas can be lessened, and it becomes possible to raise power generation performance of a fuel cell effectively.

[0018]

[Embodiment of the Invention]Drawing 1 is an important section exploded perspective view of the fuel cell 10 concerning a 1st embodiment of this invention. It has the unit fuel cell cell 12 and the 1st and 2nd separators 14 and 16 that pinch this unit fuel cell cell 12, two or more sets of these are laminated if needed, and the fuel cell 10 constitutes the fuel cell stack.

[0019]The unit fuel cell cell 12 is provided with the following.

Solid polyelectrolyte membrane 18.

The anode lateral electrode 20 and the cathode lateral electrode 22 which are allocated on both sides of this electrolyte membrane 18.

[0020]They are formed in the both sides of the unit fuel cell cell 12 by the 1st and 2nd gaskets 24 and 26, and said 1st gasket 24, While it has the big opening 28 for storing the anode lateral electrode 20, said 2nd gasket 26 has the big opening 30 for storing the cathode lateral electrode 22. The unit fuel cell cell 12 and the 1st and 2nd gaskets 24 and 26 are pinched with the 1st and 2nd separators 14 and 16.

[0021]As shown in drawing 1 - drawing 3, the 1st and 2nd separators 14 and 16 are provided with the following.

The inlet-port parts 32a and 32b for passing fuel gas, such as hydrogen gas, to each upper part side.

The inlet-port parts 34a and 34b for passing the oxidant gas which is oxygen or air.

The outlet hole part 36 for passing fuel gas and the outlet hole part 38 for passing oxidant gas are formed in the lower part side of the 1st separator 14.

[0022]As shown in drawing 2, the fuel gas flow route (the 1st gas passageway) 40 which opens the inlet-port parts 32a and 32b and the outlet hole part 36 for free passage is formed in the field 14a which counters the anode lateral electrode 20 of the 1st separator 14. The fuel gas flow route 40 is provided with the following.

The 1st and 2nd mainstream way slots 42 and 44 which are open for free passage in the inlet-port part 32a, and lie in a zigzag line toward a gravity direction (the direction of arrow A) in the field 14a.

The 3rd mainstream way slot 46 which is open for free passage in the outlet hole part 36 after said 1st and 2nd mainstream way slots 42 and 44 join in one.

The 1st and 2nd auxiliary passage slots 48 and 50 which are linearly established in a gravity

direction from the inlet-port parts 32a and 32b, and join said 1st [the] - the 3rd mainstream way slots 42, 44, and 46.

[0023]the [the 1st and] -- the 2 mainstream way slots 42 and 44 go to down (the direction of arrow A) from the upper part side of the 1st separator 14 -- mutual alienation -- being constituted so that an interval and each passage groove interval may become large, and joining mutually by the outlet hole part 36 side -- the -- the 3 mainstream way slots 46 are formed. The 1st and 2nd auxiliary passage slots 48 and 50 are provided with the following.
The straight-line parts 52 and 54 which are open for free passage in the inlet-port parts 32a and 32b, and extend in the direction of arrow A.
Two or more unification parts 56a-56d and 58a-58d which branches, respectively, curves from the way of said straight-line parts 52 and 54, and is open for free passage to the flection of the 1st and 2nd mainstream way slots 42 and 44

[0024]As shown in drawing 3, the oxidant gas passage (the 2nd gas passageway) 60 which opens the inlet-port parts 34a and 34b and the outlet hole part 38 for free passage is formed in the field 16a which counters the cathode lateral electrode 22 of the 2nd separator 16. This oxidant gas passage 60 is constituted like the fuel gas flow route 40, gives the same reference mark to the same component, and omits that detailed explanation.
[0025]Operation of the fuel cell 10 concerning a 1st embodiment constituted in this way is explained below.
[0026]Fuel gas and oxidant gas are supplied in the fuel cell 10, and this fuel gas is introduced into the fuel gas flow route 40 from the inlet-port parts 32a and 32b of the 1st separator 14. As shown in drawing 2, the fuel gas supplied to the 1st and 2nd mainstream way slots 42 and 44 from the inlet-port part 32a moves to a gravity direction, moving in a zigzag direction along the field 14a of the 1st separator 14, joins the 3rd mainstream way slot 46, and, specifically, moves to the outlet hole part 36. In that case, the hydrogen gas contained in fuel gas is supplied to the anode lateral electrode 20 of the unit fuel cell cell 12.
[0027]By a 1st embodiment, the 1st and 2nd auxiliary passage slots 48 and 50 are formed toward a gravity direction here from the inlet-port parts 32a and 32b, The unification parts 56a-56d which branch, respectively from the straight-line parts 52 and 54 which constitute these 1st and 2nd auxiliary passage slots 48 and 50, and 58a-58d are open for free passage to the flection of the 1st - the 3rd mainstream way slots 42, 44, and 46.
[0028]For this reason, when hydrogen gas is supplied to the anode lateral electrode 20 from the 1st - the 3rd mainstream way slots 42, 44, and 46 and fuel gas is consumed, Fuel gas is introduced into said 1st [the] - the 3rd mainstream way slots 42, 44, and 46 from the 1st and 2nd auxiliary passage slots 48 and 50, and the gas flow rate in these 1st-3rd mainstream way slots 42 and 44 and 46 can be raised. While making disorder of a gas stream cause and raising gas diffusion nature effectively by this, the effect of becoming possible to aim at improvement in wastewater nature is acquired.
[0029]And since a reaction is presented with the fuel gas supplied to the 1st and 2nd auxiliary passage slots 48 and 50, the increase in the reaction surface product in the field 14a of the 1st separator 14 is achieved easily. Since the supplement of fuel gas is performed from the 1st and 2nd auxiliary passage slots 48 and 50, it becomes possible to reduce effectively the pressure loss of the gas in the 1st separator 14.
[0030]Since the 1st and 2nd mainstream way slots 42 and 44 join and it becomes the 3rd mainstream way slot 46 further again, the slot number is decreasing. Therefore, the molecularity per unit area does not decrease conjointly with an operation of the 1st and 2nd auxiliary passage

slots 48 and 50, and there is an advantage that a uniform and smooth reaction is carried out effectively in the whole electrode surface of the anode lateral electrode 20.
[0031]In the 2nd separator 16, the same operation effect as the 1st above-mentioned separator 14 is obtained, and the detailed explanation is omitted.
[0032]Drawing 4 is a transverse-plane explanatory view of the 1st separator 70 that constitutes the fuel cell concerning a 2nd embodiment of this invention, and drawing 5 is a transverse-plane explanatory view of the 2nd separator 72. The inlet-port parts 74a and 74b for the 1st and 2nd separators 70 and 72 to pass fuel gas to each upper part side, While forming the inlet-port parts 76a and 76b for passing oxidant gas, the outlet hole part 78 for passing fuel gas and the outlet hole part 80 for passing oxidant gas are formed in each lower part side.
[0033]As shown in drawing 4, the fuel gas flow route (the 1st gas passageway) 82 is formed in the field 70a which counters the anode lateral electrode which the 1st separator 70 does not illustrate. The fuel gas flow route 82 is provided with the following.
The mainstream way slot 84 which lies in a zigzag line and stands in a row in the outlet hole part 78 from the inlet-port part 74a.
The 1st auxiliary passage slots 86a-86e which join said mainstream way slot 84 from said inlet-port part 74a.
The 2nd auxiliary passage slots 88a-88f which join said mainstream way slot 84 from the inlet-port part 74b.

[0034]The 1st auxiliary passage slots 86a-86e and the 2nd auxiliary passage slots 88a-88f are provided with the following.
The straight-line part 90 which is open for free passage in the inlet-port parts 74a and 74b, respectively, and extends in a gravity direction.
The unification part 92 which curves succeeding the termination of this straight-line part 90, and is open for free passage to each flection of the mainstream way slot 84.

[0035]As shown in drawing 5, the oxidant gas passage (the 2nd gas passageway) 100 is established in the field 72a which counters the cathode lateral electrode which the 2nd separator 72 does not illustrate. This oxidant gas passage 100 is provided with the following.
The mainstream way slot 102 which lies in a zigzag line and stands in a row in the inlet-port part 76a and the outlet hole part 80.
The 1st auxiliary passage slots 104a-104e which stand in a row into said mainstream way slot 102 from said inlet-port part 76a.
The 2nd auxiliary passage slots 106a-106f which stand in a row into said mainstream way slot 102 from the inlet-port part 76b.
The same reference mark is given to the same component as the fuel gas flow route 82, and the detailed explanation is omitted.
[0036]As shown [a 2nd embodiment constituted in this way] in drawing 4, when fuel gas is supplied to the mainstream way slot 84 from the inlet-port part 74a in the 1st separator 70, this fuel gas, While moving to the outlet hole part 78 side, moving in a zigzag direction in a gravity direction along said mainstream way slot 84, the anode lateral electrode which is not illustrated on the way is supplied. In that case, fuel gas is introduced into the flection of the mainstream way slot 84 through the 1st auxiliary passage slots 86a-86e and the 2nd auxiliary passage slots 88a-88f which are provided individually.
[0037]For this reason, while gas is accelerated in the mainstream way slot 84 and wastewater nature improves, reduction of the pressure loss of gas is carried out certainly. Since the 1st auxiliary passage slots 86a-86e and the 2nd auxiliary passage slots 88a-88f are formed especially

individually, respectively, the effect of the ability to make fuel gas introducing certainly at the predetermined rate of flow to each flection of the mainstream way slot 84 is acquired. Also in the 2nd separator 72, the same effect as the 1st separator 70 is acquired.

[0038]Drawing 6 is an important section exploded perspective view of the fuel cell 110 concerning a 3rd embodiment of this invention. The same reference mark is given to the same component as the fuel cell 10 concerning a 1st embodiment, and the detailed explanation is omitted to it.

[0039]The fuel cell 110 is provided with the 1st and 2nd separators 112 and 114 that pinch the unit fuel cell cell 12. To the upper part side of the 1st and 2nd separators 112 and 114. While the inlet-port part 116 for passing fuel gas and the inlet-port part 118 for passing oxidant gas are formed, The outlet hole part 120 for passing fuel gas and the outlet hole part 122 for passing oxidant gas are formed in the lower part side of said 1st and 2nd separators 112 and 114.

[0040]As shown in drawing 6 and drawing 7, the fuel gas flow route (the 1st gas passageway) 124 is formed in the field 112a where the 1st separator 112 counters the anode lateral electrode 20. The fuel gas flow route 124 is provided with the following.

The passage groove 126a which is crooked, inclines toward down in the plane direction other side portion side (the direction of arrow C), and stands in a row in the outlet hole part 120 by the side of the lower part after inclining toward down (the direction of arrow A) in the plane direction one side part side (the direction of arrow B) from the inlet-port part 116 side by the side of the upper part. The passage groove 126b which inclines in an opposite hand in this passage groove 126a, and stands in a row in said outlet hole part 120.

These passage grooves 126a and 126b are arranged toward the plane direction side part side at multiple rows from the field center section of the 1st separator 112.

[0041]As shown in drawing 6, the oxidant gas passage (the 2nd gas passageway) 128 is formed in the field 114a where the 2nd separator 114 counters the cathode lateral electrode 22. This oxidant gas passage 128 is constituted like the fuel gas flow route 124, gives the same reference mark to the same component, and omits that detailed explanation. To the 1st and 2nd gaskets 24 and 26, the anode lateral electrode 20 and the cathode lateral electrode 22 incline, and are arranged.

[0042]When fuel gas is supplied to the fuel gas flow route 124 from the inlet-port part 116, in a 3rd embodiment constituted in this way, for example in the 1st separator 112 this fuel gas, After it once inclined in the direction of arrow B toward the gravity direction along each passage groove 126a which constitutes said fuel gas flow route 124 and dropping feed was carried out by prudence, It inclines in the direction of arrow C toward a gravity direction, and the anode lateral electrode 20 is supplied, dropping feed being carried out by prudence and moving to the outlet hole part 120 side with it. Similarly, the fuel gas introduced into the passage groove 126b is supplied to the anode lateral electrode 20, inclining in the direction of arrow B toward a gravity direction, and moving to the outlet hole part 120 side, after inclining and moving in the direction of arrow C toward a gravity direction.

[0043]Thus, in a 3rd embodiment, the fuel gas flow route 124 is provided with the passage grooves 126a and 126b which constitute an approximately rhombus-like channel as a whole, and while fuel gas carries out free fall under an operation of gravity along these passage grooves 126a and 126b, the anode lateral electrode 20 is supplied. Therefore, produced water does not remain to the passage grooves 126a and 126b, and the effect that the eccritic nature of this produced water improves substantially is acquired with easy composition.

[0044]As shown in drawing 7, among the passage grooves 126a and 126b which constitute the fuel gas flow route 124, the channel 130 which directs in the direction of arrow A and has a same width dimension is formed, but. As shown in drawing 8, the channels 132a and 132b which become narrow gradually from a sliding direction toward the center of the field 112a of the 1st separator 112 can be formed. By this, the distributivity of the fuel gas in the fuel gas flow route 124 will

improve further.
[0045]Drawing 9 is an important section exploded perspective view of the fuel cell 140 concerning a 4th embodiment of this invention. The same reference mark is given to the same component as the fuel cell 10 concerning a 1st embodiment, and the detailed explanation is omitted to it.
[0046]The fuel cell 140 is provided with the 1st and 2nd separators 142 and 144 that pinch the unit fuel cell cell 12. The 1st and 2nd separators 142 and 144, The inlet-port parts 146a and 146b for passing fuel gas and the inlet-port part 148 for passing oxidant gas are formed in the upper part side, and the outlet hole parts 152a and 152b for passing the outlet hole part 150 and oxidant gas for passing fuel gas are formed in the lower part side.
[0047]As shown in drawing 9 and drawing 10, the fuel gas flow route (the 1st gas passageway) 154 which opens the inlet-port parts 146a and 146b and the outlet hole part 150 for free passage is formed in the field 142a which counters the anode lateral electrode 20 of the 1st separator 142. The fuel gas flow route 154 has the 2nd passage groove 158 that opens for free passage the 1st passage groove 156 that opens the inlet-port part 146a and the outlet hole part 150 for free passage, and the inlet-port part 146b and said outlet hole part 150. While the 1st and 2nd passage grooves 156 and 158 are formed moving in a zigzag direction in a gravity direction (the direction of arrow A), respectively, the split shape of them is independently carried out to the transverse direction (longitudinal direction) of the field 142a, respectively.
[0048]As the 2nd separator 144 is shown in drawing 9 and drawing 11, the oxidant gas passage (the 2nd gas passageway) 160 is formed in the field 144a which counters the cathode lateral electrode 22. The 1st passage groove 162 that the oxidant gas passage 160 opens the inlet-port part 148 and the outlet hole part 152a for free passage, and winds toward a gravity direction, While having the 2nd passage groove 164 that opens said inlet-port part 148 and the outlet hole part 152b for free passage, and winds in a gravity direction, said 1st and 2nd passage grooves 162 and 164 are divided crosswise, and are provided independently.
[0049]In a 4th embodiment constituted in this way, as shown in drawing 10, for example, If fuel gas is supplied to the fuel gas flow route 154 from the inlet-port parts 146a and 146b of the 1st separator 142, this fuel gas will move, moving in a zigzag direction in a gravity direction along the 1st and 2nd passage grooves 156 and 158 provided independently, respectively. For this reason, while fuel gas is supplied to the anode lateral electrode 20 from the 1st and 2nd passage grooves 156 and 158, residual fuel gas is discharged by the outlet hole part 150.
[0050]On the other hand, as shown in drawing 11, the oxidant gas supplied to the inlet-port part 148 of the 2nd separator 144 moves, moving in a zigzag direction in a gravity direction along the 1st and 2nd passage grooves 162 and 164 provided independently, respectively. Therefore, while oxidant gas is supplied to the cathode lateral electrode 22 from the 1st and 2nd passage grooves 162 and 164, residual oxidant gas is discharged by the outlet hole parts 152a and 152b.
[0051]Thus, in a 4th embodiment, the 1st and 2nd passage grooves 156 and 158 that are divided into a transverse direction and are open for free passage in the outlet hole part 150 from the inlet-port parts 146a and 146b independently, respectively are established in the field 142a of the 1st separator 142, for example. For this reason, the 1st and 2nd passage grooves 156 and 158 can short-length-ize each channel length at once, and it becomes possible to make small variation in the concentration distribution of fuel gas, and is effective in raising the power generation performance of the fuel cell 140 effectively.
[0052]Drawing 12 is a transverse-plane explanatory view of the 1st separator 170 that constitutes the fuel cell concerning a 5th embodiment of this invention used substituting the 1st separator 142 shown in drawing 10. The same reference mark is given to the same component as the 1st separator 142, and the detailed explanation is omitted to it.
[0053]The fuel gas flow route 172 is formed in the field 170a of this 1st separator 170, and this fuel

gas flow route 172 has the 1st and 2nd passage grooves 174 and 176 that open the inlet-port parts 146a and 146b and the outlet hole part 150 for free passage, respectively. The 1st and 2nd passage grooves 174 and 176 are constituted in the shape of a ladder, and the lateral channel and the channel of a lengthwise direction are mutually open for free passage.

[0054]Therefore, in the 1st separator 170, by forming the 1st and 2nd passage grooves 174 and 176 that became independent, respectively, each channel length can be short-length-ized and the same effect as the 1st separator 142 mentioned above will be acquired.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is an important section exploded perspective view of the fuel cell concerning a 1st embodiment of this invention.
[Drawing 2]It is a transverse-plane explanatory view of the 1st separator that constitutes said fuel cell.
[Drawing 3]It is a transverse-plane explanatory view of the 2nd separator that constitutes said fuel cell.
[Drawing 4]It is a transverse-plane explanatory view of the 1st separator that constitutes the fuel cell concerning a 2nd embodiment of this invention.
[Drawing 5]It is a transverse-plane explanatory view of the 2nd separator that constitutes the fuel cell concerning said 2nd embodiment.
[Drawing 6]It is an important section exploded perspective view of the fuel cell concerning a 3rd embodiment of this invention.
[Drawing 7]It is a transverse-plane explanatory view of the 1st separator that constitutes the fuel cell concerning said 3rd embodiment.
[Drawing 8]It is a transverse-plane explanatory view showing the modification of the separator shown in drawing 7.
[Drawing 9]It is an important section exploded perspective view of the fuel cell concerning a 4th embodiment of this invention.
[Drawing 10]It is a transverse-plane explanatory view of the 1st separator that constitutes the fuel cell concerning said 4th embodiment.
[Drawing 11]It is a transverse-plane explanatory view of the 2nd separator that constitutes the fuel cell concerning said 4th embodiment.
[Drawing 12]It is a transverse-plane explanatory view of the 1st separator that constitutes the fuel cell concerning a 5th embodiment of this invention.
[Description of Notations]
10, 110, 140 -- Fuel cell
12 -- Unit fuel cell cell
14, 16, 70, 72, 112, 114, 142, 144, 170 -- Separator
18 -- Electrolyte membrane
20 -- Anode lateral electrode
22 -- Cathode lateral electrode
32a, 32b, 34a, 34b, 74a, 74b, 76a, 76b, 116, 118, 146a, 146b, 148 -- Inlet-port part
36, 38, 78, 80, 120, 122, 150, 152a, 152b -- Outlet hole part
40, 82, 124, 154, 172 -- Fuel gas flow route

42, 44, 46, 84, 102 -- Mainstream way slot
48, 50, 86a-86e and 88a-88f and 104a-104e and 106a-106f -- Auxiliary passage slot
52, 54, 90 -- Straight-line part
56a-56d and 58a-58d, 92 -- Unification part
60, 128, 160 -- Oxidant gas passage
126a, 126b, 156, 158, 162, 164, 174, 176 -- Passage groove

[Translation done.]